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(71) Applicant(s)
Reuters Limited

(Incorporated in the United Kingdom)

85 Fleet Street, London, EC4P 4AJ, United Kingdom

(72) Inventor(s)
Stephen Richard Light

(74) Agent and/or Address for Service
Marks & Clerk
57-60 Lincoln's Inn Fields, LONDON, WC2A 3LS,
United Kingdom

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B6F FCHK
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(56) Documents Cited

GB 2291837 A	GB 2288911 A	GB 0708459 A
US 5578816 A	US 5272300 A	US 5234744 A
US 4755072 A	US 4656078 A	US 4365903 A

WPI Abstract Accession No. 75-J3000W/33 & NL 0146431B (WIRTH GALLO) 15.07.75 IBM Technical Disclosure Bulletin Vol.22, No. 5, October 1979, H D Underwood, pages 2014-2015

(58) Field of Search
UK CL (Edition O) B6F FCHK
INT CL[6] B41J 5/12
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(54) A keyboard having keycaps with transparent front faces

(57) A keyboard (1 Fig. 1) having at least one keycap (3,Fig.2) with a transparent front face is disclosed. The keyboard (1 ,Fig. 1) may be placed in front of a display (5,Fig.3) so that an image displayed on the display (5,Fig.3) may be visible through the keycap (3,Fig.2). The keycap (3,Fig.2) may be slidably held by guide members (4,Fig.3) which may be of an "I" shaped configuration (Fig. 2) or of a "T" shaped configuration (Fig. 3). In another embodiment, a keyboard is provided on a transparent substrate (10,Fig.5) of a display (e.g. a liquid crystal display), transparent blocks (11 ,Fig.5) being bonded to the substrate (10,Fig.5) with keycaps (12,Fig.5) having a transparent front face (20,Fig.4a) being disposed in an opaque body (19,Fig.4a) with opaque flags (18,Fig.4a) thereon, the keycaps (12,Fig 4a) being fitted onto the transparent blocks (11,Fig.5), arrays of light emitting diodes (LED's) (16,Fig.5) being provided along two adjacent edges of the substrate (11 Fig.5) and arrays of photo-diodes (17,Fig.5) being provided along the other two edges of the substrate (11,Fig.5). When a keycap (12,Fig.5) is depressed by a user, the optical paths through the gaps enclosing the keycap (12,Fig.5) are blocked by the opaque flags (18,Fig.4a) (normally above the optical paths between the LED's (16,Fig.5) and the photo-diodes (17,Fig.5) so that the outputs of the corresponding photo-diodes (17,Fig.4a) change. The keycap (12,Fig.5) that has been depressed is therefore identifiable since the gaps which are blocked are known and an image displayed on the display (10,Fig.5) will be changed accordingly.

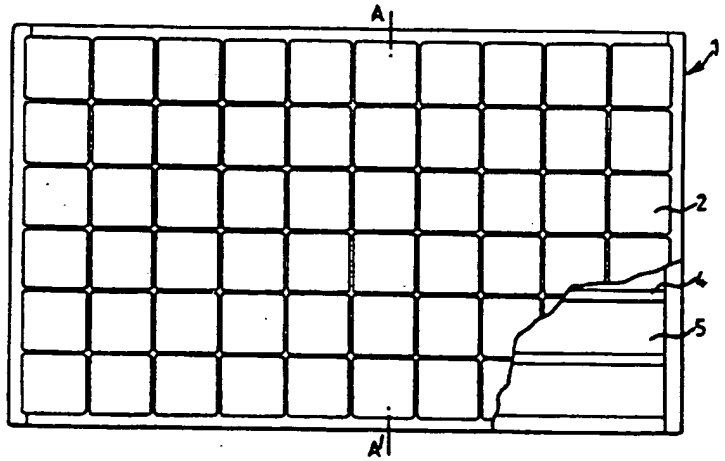

FIG.1

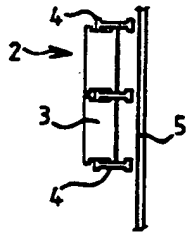

FIG.2

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

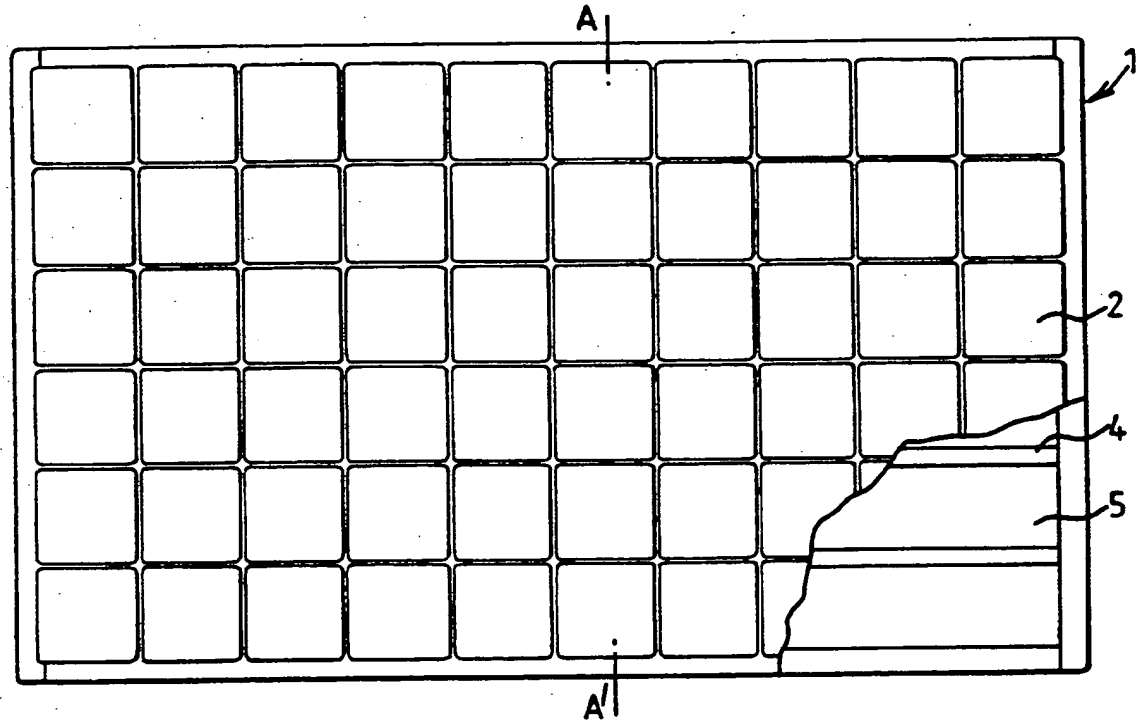


FIG.1

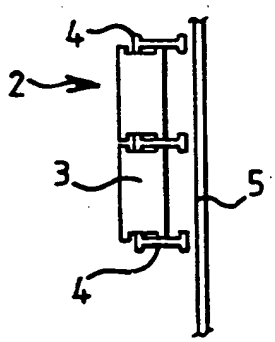


FIG.2

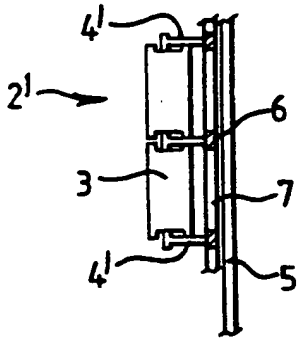


FIG.3

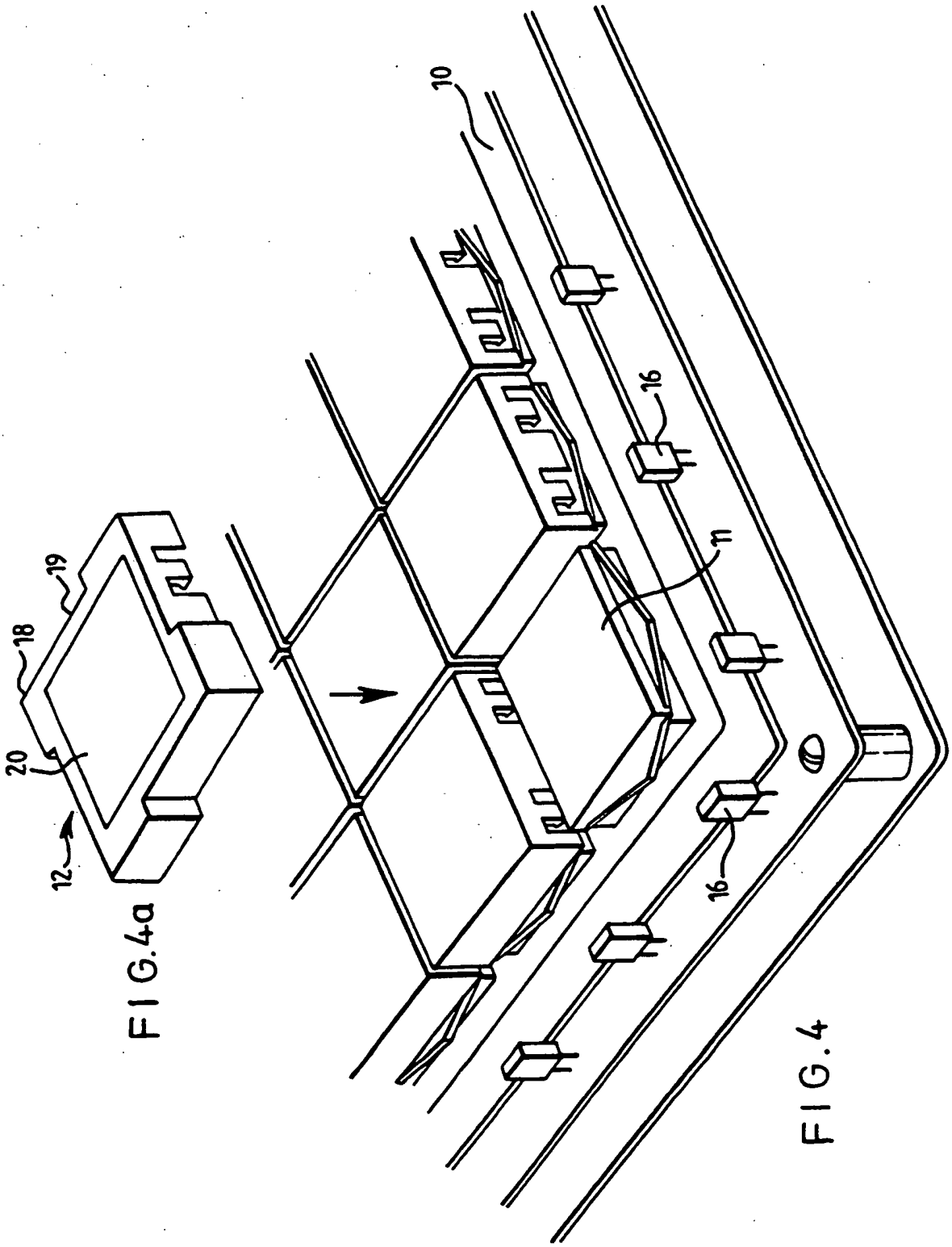


FIG.4a

FIG.4

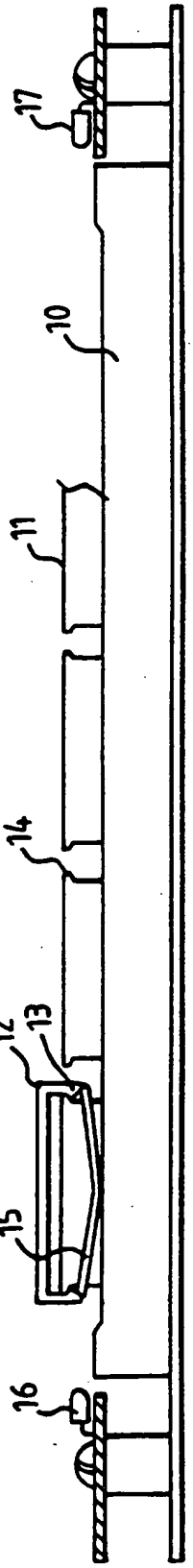
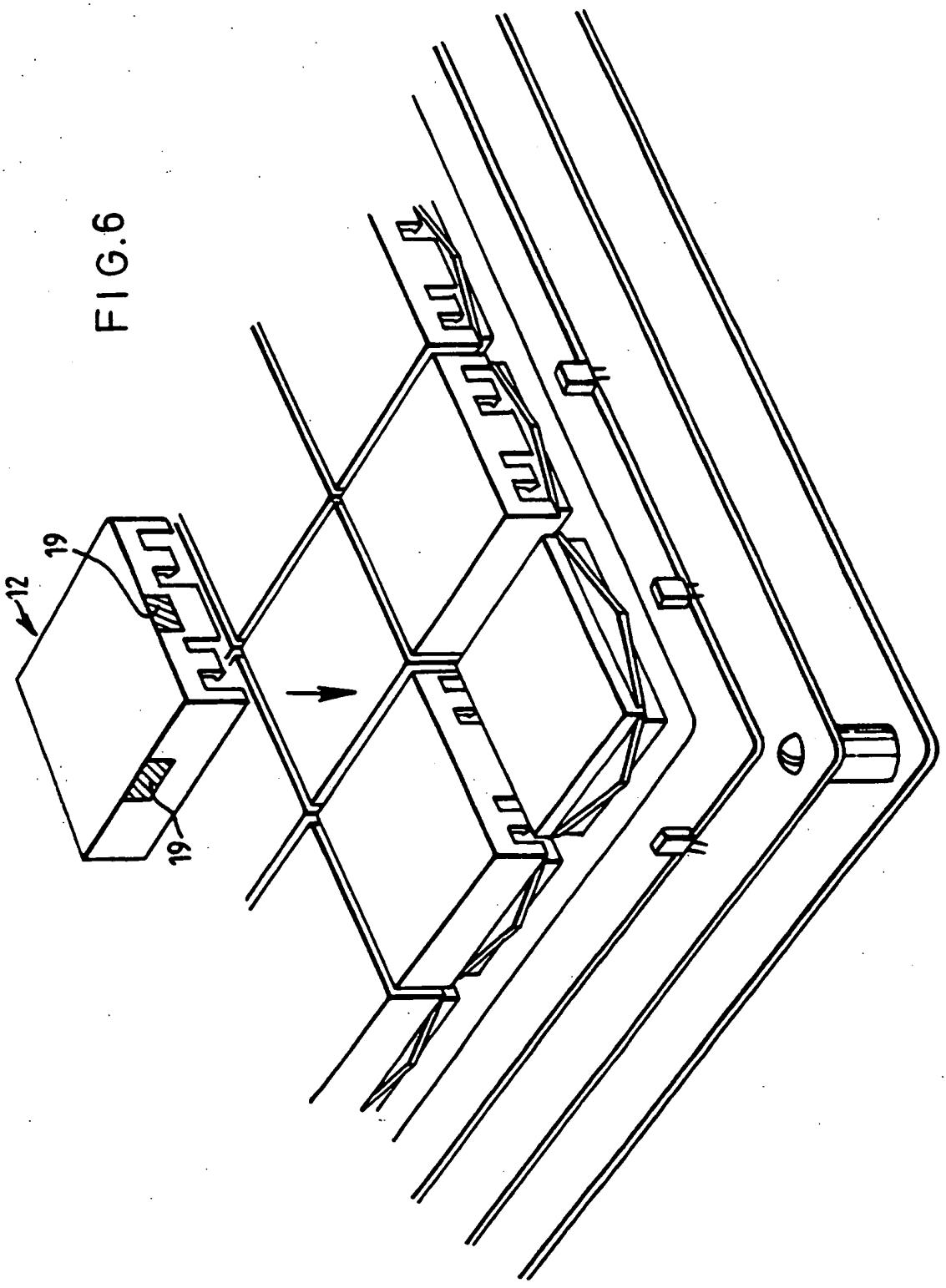


FIG.5

FIG.6



Document #: 31157

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A Keyboard

Keyboards are used to input data into many devices. When a key of the keyboard is depressed by a finger of an operator information according to the particular key depressed will be input. The keys are resiliently biased so that they spring back once the key is released. The movement of the key acts as feedback to the operator and informs the operator that the information has been entered. This tactile feedback is provided even at high rates of data input.

In most devices, the keys of a keyboard are marked on their upper surface with the character which they input when the key is depressed. It is difficult to change the image marked on a key of a conventional keyboard, even though one key can represent a number of different characters. Moreover, the image marked on a key becomes degraded as the keyboard is used, and a broken key must be replaced with another key marked with the correct character.

Another device for inputting information is a touch screen, in which information is entered by a user touching a part of the display. A touch screen can have a high quality, full colour display, and information is input at the point of display. It is straightforward to change the image displayed on the screen in response to information input by a user.

A touch screen does not provide feedback to an operator, as there is no moving part that can be sensed by the operator. Furthermore, the reliability of a touch screen is generally lower than the reliability of a keyboard.

The present invention provides a keyboard having at least one key-cap with a transparent front face. This allows an image to be displayed on a display disposed behind the key and to be viewed through the transparent key(s). The image shown on the display can be changed as a result of an operator's actions. However, this keyboard provides tactile feedback to the operator through the movement of the key, and retains the good reliability of a conventional keyboard.

Any suitable display, for example a liquid crystal display, can be used as the display. The image displayed on the display is controlled on the basis of information input using the keyboard. For example, if the keyboard is connected to a word processor, and the "control" key is depressed to change the function represented by the keys on the keyboard, the display would change to show the new functions assigned to the keys.

Alternatively, if the keyboard is connected to an information point, for example, the display could at first list a number of broad topics. When a topic is selected by pressing the appropriate key the display would change to give more details about the selected topic. This would combine the high quality display of a touch screen with the reliability and feedback of a tactile keyboard.

The present invention can also be applied to a product such as a calculator. The display can be placed under the keys, so allowing the size of the calculator to be reduced.

Preferred embodiments of the present invention will now be described by way of illustrative examples with reference to the accompanying figures in which:

Figure 1 is a schematic view of a keyboard according to one embodiment of the present invention;
Figure 2 is a cross-section through part of the keyboard of Figure 1 along the line AA'; and
Figure 3 is a cross-section corresponding to Figure 2 through a part of a keyboard according to another embodiment of the present invention;
Figure 4 is a perspective view of a keyboard according to another embodiment of the invention;
Figure 4a is an enlarged view of one key-cap of the keyboard of Figure 4;
Figure 5 is a cross-section through part of the keyboard of Figure 4; and
Figure 6 is perspective view of a keyboard according to another embodiment of the invention.

Figure 1 shows a tactile keyboard 1 which consists of a 10 by 6 array of keys 2. Each key consists of a transparent key-cap 3 which is slidably held by guiding members 4. A display 5 comprising, in this example, 6 elongate displays arranged parallel to one another is placed behind the array of keys, and an image displayed on the display is visible through the keys. The invention can, of course, be applied to any arrangement of displays.

The guiding members have an "T" cross-section, as shown in Figure 2 which illustrates two adjacent keys 2. The cross members of the "T" furthest from the display engage in recesses provided in the sides of the key-cap and limit the movement of the key-cap towards or away from the display. Each key is provided with contacts (not shown) so that depressing a key-cap will make or break an electrical circuit and thereby input information into a device connected to the keyboard. Each key is also provided with a bias member (not shown) to return the key to its usual position once the operator's finger is removed from the key.

The key-cap can be made of any suitable transparent materials, for example such as a clear plastics material. It would be possible for the key-cap to be made in two or more parts, with a transparent front face and an opaque body.

Figure 3 is a cross-section of another key 2' of this invention. The guides 4' for the key-caps 3 have a "T" section, and the base of the "T" is secured to a printed circuit board 6. The printed circuit board 6 is provided with apertures 7 which are aligned with the keys, so that the image displayed on the display 5 is visible through the keys. In this example there is one aperture for each respective key.

The cross members of the "T" section are engaged in grooves provided in the sides of the key-cap and control the movement of the key-cap as in the previous embodiment. The printed circuit board protects the display and increases the mechanical strength of the display and of the keyboard. The ON/OFF wiring for the contacts of the keys and the circuits for addressing the displays are formed on the PCB 6.

Although the invention has been described with reference to a word processor, an information point and a calculator the invention is not limited to these devices. Indeed, the present invention is applicable to any device or application which uses a display and/or a keyboard. An array of keys may, for example, be overlaid by an integral transparent flexible touch screen.

Figures 4 and 5 show another embodiment of the present invention, in which a keyboard is provided on a transparent substrate 10 of a liquid crystal display (LCD). Transparent blocks 11, which can be moulded or machined, are bonded to the substrate 10 using an optical grade adhesive. Key-caps 12 are snap-fitted onto the blocks. Springs 15 are provided to bias the key-cap away from the substrate. The key-caps are provided with projections 13 which engage with a lip 14 provided on the block 11 to retain the key-cap on the block.

Arrays of light emitting diodes 16 are provided along two adjacent edges of the substrate, and arrays of photo-diodes 17 are provided along the remaining two edges of the substrate. Each photo-diode "looks" at one LED, through the gap between two adjacent columns or rows of key-caps.

As is shown in Figure 4a, the key cap 12 has a transparent front face 20 disposed in an opaque body 19, which has four opaque flags 18. The flags 18 are normally above the optical paths between the LEDs and the photo-diodes 17. When a key-cap is depressed by a user, the optical paths through the four gaps enclosing the key-cap are blocked by the flags 18, so that the outputs of the four corresponding photo-diodes change. The key that has been depressed is identified from knowledge of which gaps are blocked, and the image displayed on the LCD is changed accordingly.

It is not necessary to place the LEDs on two sides and the photo-diodes on the other two sides; all that matters is that there is one LED and one photo-diode for each gap. It would be possible to provide all four sides with a mixture of LEDs and photo-diodes, and LEDs and photo-diodes could be alternated along all four sides.

The flags 18 can be arranged in ways other than that shown in Figure 4a, provided that depressing a key-cap completely blocks the four beams and that a key-cap can freely move past adjacent key-caps. It would be possible to provide the flags on only two, adjacent sides of the key-cap, so that depressing a key-cap

would block only one light path in the row direction and one light path in the column direction.

Figure 6 shows a modified embodiment, in which only two LEDs are provided for each key-cap (one emitting in the "row" direction and the other emitting in the "column"). Each transparent key-cap is provided with at least two opaque regions 19 which block the light paths when the key is depressed. The optical paths pass through the blocks in this embodiment, and care has to be taken to avoid unwanted reflections of the light beams.

A keyboard according to either of these embodiment again combines the display qualities of a touch screen with the feedback of a tactile keyboard.

Possible materials for the blocks are Acrylic, as this has good optical characteristics, and for the key-cap are polycarbonates. The thickness of the key-caps will be determined by the need for both mechanical strength and good optical properties. An industry standard adhesive used for adhering resistive touch overlays would be suitable for bonding the blocks to the display.

Although the embodiments described use an LED and a photo-diode, any suitable combination of light emitter and photo-detector can be used. The intensity of the light emitted by the optical source may be modulated, so that a "lock-in" detection method can be used. This would be particularly preferable if an optical source emitting visible light was used.

Although the keyboards described with reference to Figures 4 to 6 are provided on an LCD display, the invention is not limited to use with an LCD display. The keyboards could be disposed on, for example, a cathode ray tube display or any other suitable display..

It would be possible for the optical detection of movement of the key-caps to be incorporated in the keyboards illustrated in Figures 1, 2 and 3. Conversely, the keyboards shown in Figures 4, 5 and 6 could be provided with electrical contacts such that depressing a key-cap either completed or broke an electrical circuit. Indeed, any method for detecting the movement of a key-cap could be used.

It would also be possible for the optical detection of movement of the key-caps to be applied to a conventional keyboard having opaque key-caps.

It would be possible for a keyboard to have both transparent and opaque key-caps. For example, if the keyboard is larger than the display area of the display opaque key-caps can be provided over the non-display area of the display device.

Claims

1. A keyboard having at least one key-cap with a transparent front face.

2. A keyboard as claimed in claim 1 and further comprising a display, wherein one area of the display is visible through the transparent front face of the key-cap.

3. A keyboard substantially as described herein with reference to Figures 1 and 2 or to Figures 1 and 3.

4. A keyboard substantially as described herein with reference to Figures 4, 4a and 5 or to Figure 6.

Amendments to the claims have been filed as follows

1. A display device comprising: a display means for displaying an image; and an array of tactile key-caps disposed over the display means, the key-caps having transparent front faces whereby at least part of the image displayed on the display means is visible through the key-caps;

wherein the image displayed on the display means can be changed by depressing one or more key-caps.

2. A display device as claimed in claim 1 and further comprising a transparent, flexible screen disposed over the keyboard.

3. A display device as claimed in claim 1 or 2 wherein the keyboard further comprises an opaque key-cap.

4. A display device as claimed in claim 3 wherein the keyboard extends over a larger area than the display means, the opaque key-cap of the keyboard being disposed in a part of the keyboard that does not overlay the display means.

5. A display device substantially as described herein with reference to Figures 1 and 2 or to Figures 1 and 3.

6. A display device substantially as described herein with reference to Figures 4, 4a and 5 or to Figure 6.

The Patent Office

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Application No: GB 9610559.8 **Examiner:** Gary Williams
Claims searched: 1-4 **Date of search:** 12 August 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): B6F: FCHK

Int Cl (Ed.6): B41J: 5/12

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2291837 A	(SILITEK) See Figure 1 and page 2,lines 11-20	1
X	GB 2288911 A	(SILITEK) See Figure 1 and page 4,lines 2-7	1
X	GB 0708459	(CREED & CO.) See Figure 1 and page 1,lines 52-66	1
X	US 5234744	(SUNARROW) See Figure 1 and col.5,lines 3-11	1
X	US 4755072	(HOORNWERG) See Figure 1 and col.1,lines 15-32	1
X	US 4656078	(BROTHER) See Figure 2 and col.2,lines 44-57, col.4,lines 3-10	1
X	US 4365903	(SIEMENS) See Figure 1 and col.2,lines 40-54	1,2
X	WPI Abstract Accession No. 75-J3000W/33 & NL 0146431 B (WIRTH GALLO) 15.07.75 (see abstract)		1
X	IBM Technical Disclosure Bulletin Vol.22, No. 5, October 1979, H D Underwood, "Integral Hinged Clear Key Cap", pages 2014-2015, especially page 2014		1

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Y Document indicating lack of inventive step if combined with one or more other documents of same category.
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